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EXAMINER

COMPTON, ERIC B

ART UNIT	PAPER NUMBER
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3726

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/069,384

Applicant(s)

JULIEN, GERALD J.

Examiner

Eric B. Compton

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 12-20 is/are rejected.
- 7) ☒ Claim(s) 11 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Specification***

1. This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required.

### ***Claim Objections***

2. Claim 11 is objected to because of the following informalities: in line 4, "roller" should read --rolling--corresponding to the preamble language of claim 1.
3. Claim 18 is objected to because of the following informalities: in line 4, --and-- should be inserted before the last limitation step. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11 recites the limitation "said Nitinol bar" in line 3. There is insufficient antecedent basis for this limitation in the claim. The Examiner is interpretation this limitation as "said Nitinol form."

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,843,152 to Tu et al.

Tu et al disclose a sphere (14, e.g. a ball) of Nitinol. See Col. 6, lines 26-29. "NiTi represents nickel-titanium alloys which are commonly referred to as Nitinol alloys. This abbreviations will include alloys containing from 53 to 62, ... weight percent of nickel with the remainder of the alloy being essentially titanium." See U.S. Patent 4,561,272, at Col. 2, lines 8-13. However, the reference does not explicitly disclose the use of Nitinol 60 alloy.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used Nitinol 60 alloy, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416 (CCPA 1960). Furthermore, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (BPAI 1987).

8. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,561,272, to Goldstein.

Goldstein discloses a rod (10) of Nitinol. See Col. 2, lines 27-28. "NiTi represents nickel-titanium alloys which are commonly referred to as Nitinol alloys. This abbreviations will include alloys containing from 53 to 62, ... weight percent of nickel with the remainder of the alloy being essentially titanium." *Id.*, at lines 8-13. However, the reference does not explicitly disclose the use of Nitinol 60 alloy.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used Nitinol 60 alloy, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416 (CCPA 1960). Furthermore, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (BPAI 1987).

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,324,441 to Rouverol et al.

Rouverol et al disclose an annular ring (132,133) of a shape-memory nickel-titanium alloy. See Col. 6, lines 21-43. Nitinol is a shape-memory alloy of nickel and titanium. See generally U.S. Pat. 4,657,822, Col. 4, lines 27-29. "NiTi represents nickel-titanium alloys which are commonly referred to as Nitinol alloys. This abbreviations will include alloys containing from **53 to 62**, ... weight percent of nickel with the remainder

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of the alloy being essentially titanium.” See U.S. Patent 4,561,272, at Col. 2, lines 8-13 (emphasis added). However, the reference does not explicitly disclose the use of Nitinol 60 alloy.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used Nitinol 60 alloy, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416 (CCPA 1960). Furthermore, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (BPAI 1987).

10. Claims 1, 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al in view of U.S Patent 3,283,376 to Hockin and U.S. Patent 3,422,663 to James et al.

Rouverol et al disclose the use of nickel-titanium shape-memory alloys for bearing parts. Col. 6, lines 21-33; Col 5, lines 26-30 (contemplating roller bearings).

Because of the large critical dimension changes as they are heated through the critical temperature, shape-memory materials are useful in the present invention both for rolling surfaces and the prestressing elements. In the case of rolling surfaces, the prestressing techniques herein describes overcome the disadvantages that nickel-titanium is not hardenable, allowing greatly increased Hertzian pressures which combine with a low Young's modulus to give a modulus of resilience comparable to that of hardened steel.

Col. 6, lines 34-43. Nitinol is a shape-memory alloy of nickel and titanium. See generally U.S. Pat. 4,657,822, Col. 4, lines 27-29. “NiTi represents nickel-titanium alloys

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which are commonly referred to as Nitinol alloys. This abbreviations will include alloys containing from **53 to 62**, ... weight percent of nickel with the remainder of the alloy being essentially titanium.” See U.S. Patent 4,561,272, at Col. 2, lines 8-13 (emphasis added). However, the reference does not explicitly disclose the use of Nitinol 60 alloy.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used Nitinol 60 alloy, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416 (CCPA 1960).

However, Rouverol et al do not discloses forming the bearing elements by a casting process.

Hockin discloses utilizing sand casting molds to form various shapes of bearing components, esp. spherical balls (2). The method comprises: making a sand mold having a cavity with an internal shape like the desired shape of the element formed (see Figure 3); pouring molten metal into the cavity cooling the mold to solidify the molten metal form (col. 3, lines 23-35); and disintegrating the mold to remove metal form (inherent with an investment sand casting method). The bearing parts are then individually removed from a solidified branch of the casting.

It would have been obvious to one having ordinary skill in the art at the time the invention was made, to have formed the Nitinol bearings elements of Rouverol et al, by a casting process, in light of the teachings of Hockin, in order to “yield a substantially

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spherical ball bearing which is sufficiently exact in dimension to eliminate or significantly reduce subsequent machining." Col. 3, lines 45-47.

However, Rouverol et al/Hockin do not disclose that the mold is a ceramic mold.

James et al discloses that sand mold casting and ceramic mold casting are well known and equivalents in the casting art. Col. 1, lines 40-49 ; **See** also U.S. Patent 4,938,802 to Noll et al, Col.,1, lines 12-30 (disclosing both ceramic and sand molds). Furthermore, the reference suggests that ceramic molds are less expensive than sand molds and easier to fabricate.

Regarding claims 1 and 5, it would have been obvious to one having ordinary skill in the art at the time the invention was made, to have formed the Nitinol bearings elements of Rouverol et al/Hockin, by a casting process using a ceramic mold, in light of the teachings of either James et al or Noll et al, since sand molds and ceramic molds are known equivalents. *See In re Ruff*, 256 F.2d 590, 598 (CCPA 1958) (equivalence may be suggested by prior art).

Regarding claim 7, Hockin discloses that the balls may require some subsequently machining to yield a perfect sphere. Col. 3, lines 45-47. This clearly suggests a grinding process as known in the art.

11. Claims 2, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al/Hockin/James et al in view of U.S Patent 4,302,256 to Kenton.

Rouverol et al/Hockin/James et al disclose the invention cited above. However, they do not disclose providing a hot isostatic pressing (HIP) treatment.



Kenton discloses generally providing a HIP treatment for castings in order to reduce and eliminate defects (e.g., microcracks) in the castings. See Abstract. The process is especially advantageous to nickel and titanium based alloys. Col. 1, lines 5-13. The reference discloses temperatures from about 1800 to 2350 °F and pressures from 5,000 to 50,000 psi for ½ to 16 hours, depending on the particular alloy. Col. 5, lines 58-67. See *also* U.S. Patent 3,496,624 to Kerr et al (disclosing temperatures from 700 to 1000 °F and pressures from 10,000 to 100,000 psi).

Regarding claims 2 and 6, it would have been obvious to one of ordinary skill in the art to have provided the bearing element of Rouverol et al/Hockin/James et al with a HIP treatment, in light of the teachings of Kenton, in order to reduce or eliminate defects in the casting. Regarding the specific particulars of the temperature, pressure, and time claimed, it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

12. Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al/Hockin/James et al in view of U.S. Patent 1,472,922 to Lothrop and U.S. Patent 5,928,065 to Shih.

Rouverol et al/Hockin/James et al disclose the invention cited above. Rouverol et al disclose forming roller bearing element, including rod-shaped roller elements (131). Thus, if such elements are formed by the method of Hockin then a rod of Nitinol would be inherently formed. Furthermore, Hockin suggests that the bearing elements may require some subsequently machining to yield a perfect shape.

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However, they do not disclose cutting individual bearing parts from a rod or centerless grinding.

Lothrop disclose forming bearing elements (E) from a rod (A). The maximum diameter of the rod is first machining and then the individual elements (D) are cut to length for further processing. See Figures 1&4. This allows for much of the machining to desired shape to be performed on a plurality of bearing elements prior to cutting them off the rod. Page 2, Col. 2, lines 2-3.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have cast a rod of Nitinol as taught by Rouverol et al/Hockin/James et al, machining the rod and cut out individual parts to become bearing parts, in light of the teachings of Lothrop, in order to increase efficiency.

However, the references do not disclose centerless grinding.

Shih disclose a method and apparatus for centerless grinding bearing parts. See Col. 1, line 19. Centerless grinding is "especially advantageous for grinding applications wherein the final ground workpiece dimension must fall within sub-micron tolerance requirements." Col. 8, lines 49-50.

Regarding claim 3, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have have ground the bearing elements of Rouverol et al/Hockin/James et al/Lothrop by a centerless grinding process, in light of the teachings of Shih, in order to provide sub-micron tolerances for bearing parts.

Regarding claim 4, the references, especially Hockin, suggest final grinding the individual bearing elements. Thus, it would have been obvious to perform the final grinding by centerless grinding as suggested by Shih.

13. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al/Hockin/James et al in view of U.S Patent 4,023,988 to Stickels et al.

Rouverol et al/Hockin/James et al disclose the invention cited above. However, they do not disclose a hardened step (i.e., heating and quenching) to increase the hardness of the bearing element.

Stickels et al disclose generally that it is known to provide a heat treatment to bearing elements to improve resistance to rolling contact fatigue. "When the rough formed shapes have become fully austenitized, they are quenched in hot oil ... and are tempered to a final hardness of Rc 60-64 using tempering ..." Col. 2, lines 26-31. It is well known in the art that the process of quenching resulting in the formation of some of the austenite, especially on the surface to martensite, a hard ceramic material. See Heat Treatment of Steels – An Overview. Nitinol is capable of assuming a martensite structure as well. See Selected Properties on NiTi Data Sheet. Furthermore, Applicant discusses that "[Nitinol] is naturally hard and can be heat treated to a hardness on the order of 62Rc or higher." Specification, page 3.

Regarding claim 8, it would have been obvious to one of ordinary skill in the art to have provided the bearing element of Rouverol et al/Hockin/James et al with a heat treatment to produce a hardness of 62Rc, in light of the teachings of Stickels, in order to increase its "life against rolling contact fatigue." Col. 1, lines 49-50. Regarding the

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specific particulars of the temperature claimed, it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

14. Claims 12-15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al in view of U.S Patent 4,216,629 to Degaeta.

Rouverol et al disclose the invention cited above. However, Rouverol et al do not disclose forming the ball bearing elements by the process as claimed.

DeGaeta discloses a method of forming ball bearing parts (col. 1, lines 6+) comprising: grinding the ball blanks in a ball grinder to a desired spherical shape and size. See Col 1., lines 36+. Cylindrical blanks are disclosed to be formed from wire stock. Col. 4, lines 46-48. In the case of non-cylindrical blanks that are cubical (see col. 1, line 38), a skilled artisan would realize that sheet or plate material having a desired cross-section would be advantageous to use to reduce waste. See *generally* U.S. Patent 2,358,378 to Brenholtz, Page 2, Col. 1, lines 47-51 (disclosing cutting rectangular blanks from bar stock).

Regarding claim 12, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have formed the Nitinol bearing elements of Rouverol et al, by the ball bearing forming process of DeGaeta, in order to "produce substantially spherical balls which are very close to the desired finished size ..." Col. 1, lines 59-60.

Regarding claim 13-14, and 16, DeGaeta discloses the blanks may be cylindrical or cubical. Col. 1, line 39. Note: a cube by definition has a center and six equal orthogonal dimensions through the center.

Regarding claim 17, DeGaeta disclose the blanks are tumbled until they are substantially spherical and then they are lapped (i.e., ground). Col. 1, lines 46-56.

15. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al/DeGaeta in view of U.S. Patent 4,724,297 to Nielsen.

Rouverol et al/DeGaeta disclose the invention cited above. It is inherent that the blanks are cut from the stock material. However, the references do not disclose laser cutting.

Nielsen disclosed generally industrial laser cutting techniques to cut metallic workpieces from sheet material to avoid the formation of burrs. See Abstract.

Regarding claim 16, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have cut the blanks of Rouverol et al/DeGaeta by laser cutting, in light of the teachings of Nielsen, in order to eliminate burrs formed by conventional cutting.

16. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al in view of U.S Patent 1,472,922 to Lothrop.

Rouverol et al disclose the invention cited above However, Rouverol et al do not discloses forming the ball bearing races by the process as claimed.

Lothrop discloses a method of forming bearing races (E), comprising: selecting a tube (B.C) having a central axis; cutting bearing race blanks (D) off the tube at a plane

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perpendicular to the central axis (see Figures 4-5); and grinding or machining the race blanks to desired outside configuration and interior configuration (see Figure 2; Col. 3, lines 25-27). It is known in the art to form bearing races from bars or tubes. Col. 1, lines 14-28.

Regarding claim 18, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have formed the Nitinol bearing races of Rouverol et al, by cutting blanks from a rod, in light of the teachings of Sommer et al, in order to increase production efficiency. Col. 2, lines 66-68.

17. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rouverol et al/Sommer et al in view of U.S. Patent 4,023,988 to Stickels et al.

Rouverol et al/Sommer et al disclose the invention cited above. However, they do not disclose a hardened step (i.e., heating and quenching) to increase the hardness of the bearing element.

Stickels et al disclose generally that it is known to provide a heat treatment to bearing elements to improve resistance to rolling contact fatigue. "When the rough formed shapes have become fully austenized, they are quenched in hot oil ... and are tempered to a final hardness of Rc 60-64 using tempering ..." Col. 2, lines 26-31. It is well known in the art that the process of quenching resulting in the formation of some of the austenite, especially on the surface to martensite, a hard ceramic material. See Heat Treatment of Steels – An Overview. Nitinol is capable of assuming a martensite structure as well. See Selected Properties on NiTi Data Sheet. Furthermore, Applicant

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discusses that “[Nitinol] is naturally hard and can be heat treated to a hardness on the order of 62Rc or higher.” Specification, page 3.

Regarding claim 19, it would have been obvious to one of ordinary skill in the art to have provided the bearing element of Rouverol et al/Sommer et al with a heat treatment to produce a hardness above 58Rc, in light of the teachings of Stickels, in order to increase its “life against rolling contact fatigue.” Col. 1, lines 49-50. Regarding the specific particulars of the temperature claimed, it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

#### ***Allowable Subject Matter***

18. Claim 11 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

19. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record does not teach or suggest a method of forming Nitinol bearing comprising: casting a Nitinol rod and rotary forging the rod at an elevated temperature to produce a rod having a diameter slightly greater in diameter than the rolling bearing elements, in combination with the other claimed subject matter.

***Prior Art References***

The prior art references listed on the enclosed PTO-892, but not used in a rejection of the claims, are cited for their teachings of Nitinol parts.

***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Compton whose telephone number is (703) 305-0240. The examiner can normally be reached on M-F, 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory M. Vidovich can be reached on (703) 308-1513. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1148.



Eric Compton  
Patent Examiner  
A/U 3726  
September 2, 2003